

COPY

S/N 09/376,875

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Gregory M. Chrysler et al.

Examiner: Christopher Atkinson

Serial No.: 09/376,875

Group Art Unit: 3743

Filed: August 18, 1999

Docket: 884.148US1

Title: FOLDED FIN HEAT SINKS

DECLARATION UNDER 37 C.F.R. § 1.131

Commissioner for Patents
Washington, D.C. 20231

This declaration is submitted under 37 C.F.R. § 1.131 prior to final rejection of U.S. Patent Application Serial Number 09/376,875 to establish invention of the subject matter of the rejected claims prior to the effective date of Wotring (U.S. 6,199,624) on which the rejections are based.

I, Gregory M. Chrysler, declare and say as follows:

1. On August 18, 1999, the filing date of the present application, I was an employee of Intel Corporation, the assignee of the present application.

2. I am a joint inventor of all claims of the present application.

3. Prior to April 30, 1999, I conceived the invention in the United States as evidenced by a signed invention disclosure form attached hereto as Exhibit A and diligently worked to constructively reduce the invention to practice as evidenced by the filing of a patent application for the claimed invention. I worked with a patent attorney as my other duties permitted in preparing several drafts of the application. A draft of the application was received in July of 1999 and reviewed in due course. A second draft of the application was received in August of 1999 and reviewed in due course.

4. The dates redacted from Exhibit A are prior to April 30, 1999.

5. The patent application was filed August 18, 1999.

6. The invention was completed by me as the co-inventor of the subject matter of claims under rejection.

7. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like are

BEST AVAILABLE COPY

COPY

Serial Number: 09/376,875
Filing Date: August 18, 1999
Title: FOLDED FIN HEAT SINKS

Page 2
Dkt: 884.148US1

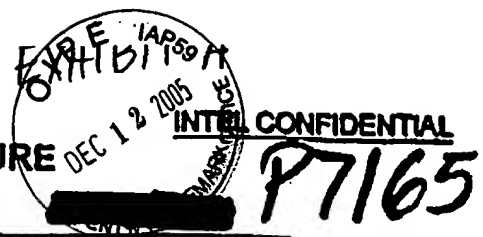
punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

Date: 10/4/2001

Gregory M. Chrysler
Gregory M. Chrysler

COPY

INTEL INVENTION DISCLOSURE



LEGAL ID#

11394-TMG/
TM Comm / TMG/ ATDDATE:

It is important to provide accurate and detailed information on this form. The information will be used to evaluate your invention for possible filing as a patent application. When completed, please return this form to the Legal Department at JF3-147. If you have any questions, please call 264-0444 or 264-0998.

✓ 1. Inventor: Chrysler Gregory M
Last Name First Name Middle Initial
SS# WWID 10571428 Phone 602-552-6880 M/S: CH7307
Home Address: 411 N. Diane Ct. City Chandler State AZ Zip 85226
Citizenship: USA BUM Presenter:
Group: (e.g. TMG, ICG, CEG) TMG Division Name MTO Subdivision
Supervisor Mike Garner WWID 10032478 Phone 408-765-2588 M/S: SC4-130

✓ 2. Inventor: Goodman Jack J.
Last Name First Name Middle Initial
SS# WWID 10558295 Phone 602/552-3378 M/S: CH5-157
Home Address: 364 E Catclaw City Gilbert State AZ Zip 85298
Citizenship: USA BUM Presenter:
Group: (e.g. TMG, ICG, CEG) TMG Division Name ATD Subdivision OPD
Supervisor Brian Deford WWID 10031635 Phone 602/554-2921 M/S: CH5-157

(PROVIDE SAME INFORMATION AS ABOVE FOR EACH ADDITIONAL INVENTOR)

2. Title of Invention: Folded Fin Fan Sink (FFF-Sink)
3. What technology/product/process (code name) does it relate to: Willamette
4. Stage of development (i.e. % complete) 25%
5. (a) Has a description of your invention been, or will it shortly be, published outside Intel:
NO: X YES: DATE WAS OR WILL BE PUBLISHED:
If YES, was the manuscript submitted for pre-publication approval? YES: NO:
- (b) Has your invention been used/sold or planned to be used/sold by Intel or others?
NO: X YES: DATE WAS OR WILL BE SOLD: Under Evaluation for Intel Use
- (c) Does this invention relate to technology that is or will be covered by a SIG (special interest group)/standard/ or specification?
NO: X YES: Name of SIG/Standard/Specification:
- (d) If the invention is a semiconductor device, actual or anticipated date of tapeout?
- (e) If the invention is software, actual or anticipated date of any beta tests.
6. Was the invention conceived or constructed in collaboration with anyone other than an Intel blue badge employee or in performance of a project involving entities other than Intel, e.g. government, other companies, universities or consortia?
NO: X YES: Name of individual or entity:

1. Describe in detail how the invention works.

A fan-sink has two fundamental components, namely a heat sink and a fan. The fan is typically mounted to the top of the heat sink (see figure 1).

When a folded fin arrangement is used the airflow is ordinarily directed parallel to the cooling fins and parallel to the heat spreader base for optimum cooling fin exposure. A standard fan sink however, requires the airflow to be directed normal to the heat spreader base (see figure 1). This arrangement is not favorable for the basic folded fin because the cooling fins will only realize half of their potential (forced air) exposure (see figure 3).

Optimal fin exposure (to airflow normal to the heat spreader base) is realized by trimming the folded fins (as shown in figures 1-3). With this modification, forced air from the top of the heat sink is allowed to encounter all surfaces of the cooling fins.

Compared to the unmodified (untrimmed) folded fin fan sink, the modified is markedly more efficient (in the range of 50).

Trimming the folded fins may be accomplished in several ways including:

- ♦ Fly-cut the folded fins in a post-folded condition.
- ♦ Stamp out slots in the fin material prior to the folding operation. This is the basis of our invention.

Folded fin fan heat sinks are currently manufactured by creating the folded fin bundles on automation equipment and attaching them to a base spreader plate. The slots for air flow passages at the tops of the folds are created through a post-assembly operation. The folding automation equipment is adjustable to allow for different fin heights, thickness and fin pitch, but once set up it typically is not readjusted until a new batch of fin bundles are to be created. A continuous (typically coil) of fin sheet stock is fed into the equipment and is folded to the appropriate dimensions and cut to size. By placing cutting dies in the assembly line of the automated folding equipment the slots could be stamped in the desired places in the fin sheet stock before folding so that the opening would be positioned at the tops of the folds, eliminating the post assembly cutting of the assembled heat sink. This same technique could be used to pre-place cutouts for mounting screws, or any other open-type features in the fin bundles.

2. Describe advantage(s) of your invention over what is done now.

The primary advantage of the FFF-Sink (over standard fan-sinks) is optimal cooling fin density at the lowest cost. Since the FFF-Sink is an assembly, there are a number of operations to complete the manufacturing of such a heat sink. This invention cuts number of post-assembly operations (namely the fly-cutting of the slots) by replacing it with a pre-assembly operation. The switch involved can reduce the total cost in two ways: 1) the pre-assembly operation becomes part of the folded fin automation set-up saving a post operation set-up and reducing assembly time, and 2) the possibility of an assembled heat being damaged, resulting in reduced yield and high scrap is eliminated.

Listed below are standard fan-sinks and correlating advantaged of the FFF-Sink

| Heat Sink Type | Advantage(s) FFF-Sink |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Extruded | 1) Aspect ratio of FFF-Sink is much better, 20-30 to 1, as opposed to 10 to 1 for extruded--improved efficiency 2) use of variant material heat spreader base is possible with FFF-Sink allowing more flexible heat spreading |

Single Fin, Bonded Fin

1) FFF-Sink less expensive because folded fin much easier to assemble to spreader base than single fin (one piece to assemble instead of 20 plus)

3. Include at least one figure illustrating the invention.. If the invention relates to software, include a flowchart or pseudo-code representation of the algorithm.

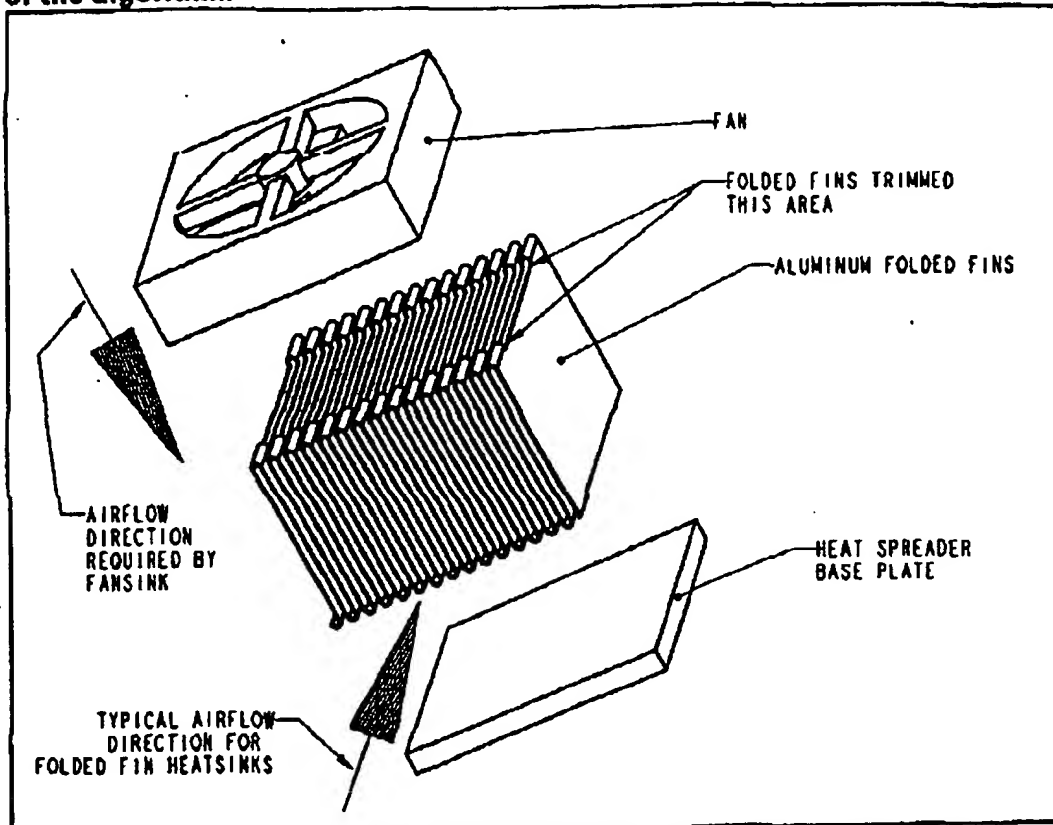


Figure 1. Pre-Assembled (exploded) isometric View of FFF-Sink.

COPY

INTEL CONFIDENTIAL

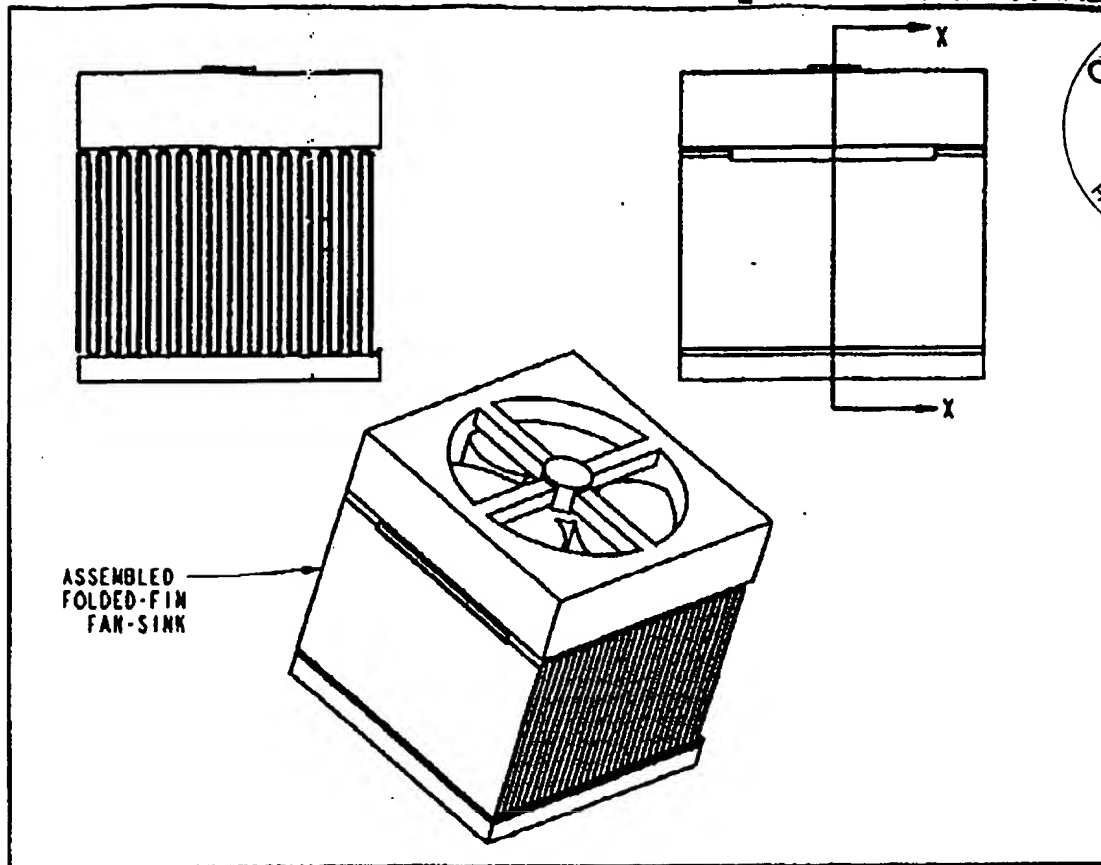
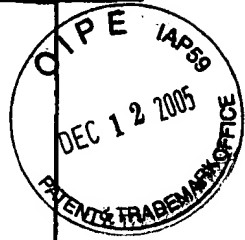


Figure 2. Assembled Isometric View of FFF-Sink.

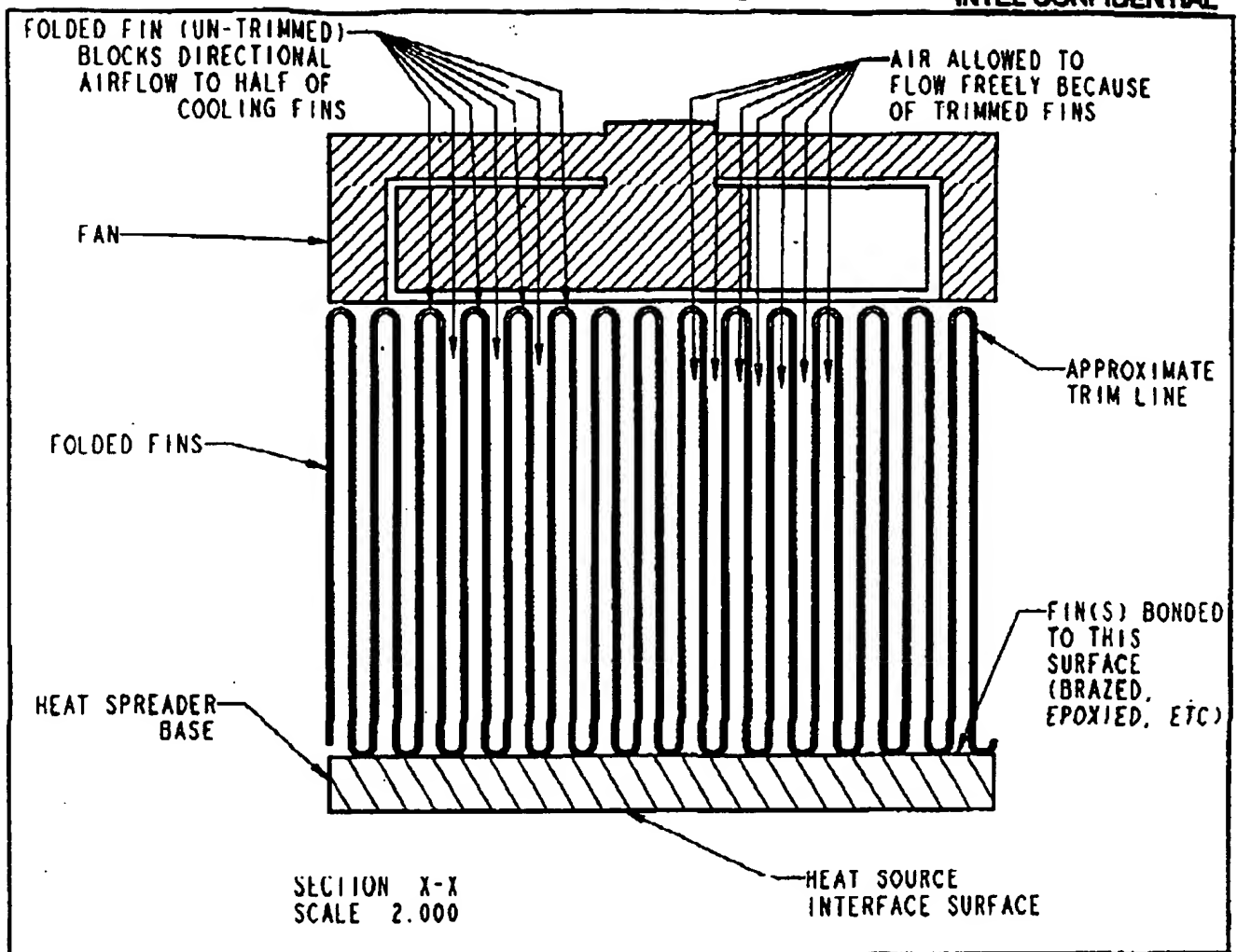


Figure 3. Sectioned View of FFF-Sink

4. Value of your invention to Intel (how will it be used?).

The FFF-Sink is currently in urgent demand for the Willamette (development underway) generation of desktop/server products. The current design target is 70 watts with a push to a 5 watt added delta (75W). Thermal cooling solutions with high efficiency and low cost are critical to the success of this product, as well as follow-on products.

The FFF-Sink may also be adapted for other high-wattage/limited-space microprocessors as required such as McKinley.

Willamette will use the FFF-Sink as a complete CPU/cooling-solution package and/or enabled for Intel Corp. customers (OEM's) to deploy in their products.

5. Identify the closest or most pertinent prior art that you are aware of.

As noted in section 2, there are two (fundamental) existing fan-sink (heat sink) variations:

- 1) Extruded heat sink (typically aluminum) with attached fan
- 2) Single-Fin bonded fin heat sink (typically aluminum) with attached fan

COPY

INTEL CONFIDENTIAL

6. Who is likely to want to use this invention or infringe the patent if one is obtained and how would infringement be detected?

Competition in the CPU segment (desktop and server), and their thermal solution suppliers.

***HAVE YOUR SUPERVISOR READ, DATE AND SIGN COMPLETED FORM**

DATE:

[REDACTED]

SUPERVISOR:

e Michael James

BY THIS SIGNING, I (SUPERVISOR) ACKNOWLEDGE THAT I HAVE READ AND UNDERSTAND THIS DISCLOSURE, AND RECOMMEND THAT THE HONORARIUM BE PAID

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☒ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.